ABSTRACTS OF THE PHYSICO-CHEMICAL LITERATURE IN JAPAN

Vol. XIII August, 1939 No. 4

1—GENERAL AND PHYSICAL CHEMISTRY

42. **Contact potential of two electronic gases at different magnetic states.** T. Takéuchi. *Bull. Tokyo Univ. Eng.*, **7**, 511—512 (1938).—Contact potential difference between two electronic gases, one magnetized while the other non-ferro-magnetized, is quantum-mechanically treated. Author.

43. **A study on Joule-Thomson effect of photon gas.** T. Takéuchi. *Bull. Tokyo Univ. Eng.*, **7**, 529—530 (1938).—It is shown that in a Joule-Thomson expansion photon gas no change in temp. is observed. Efficiency of Carnot's engine using photon gas as acting material is also considered. Author.

44. **On the solubility of sodium amide in liquefied ammonia.** S. Sigetomi. *J. Soc. Chem. Ind. Japan*, **41**, 849—852 (1938).—The binary system $NaNH_2$-NH_3 and the ternary system $NaNH_2$-NaCl-NH_3 are investigated within the temp. range from -20°C to +20°C. The solubility of sodium amide in liquid ammonia is detd. and the results obtained are as follows:

Temp. (°C)	20	10	0	-10	-20
Solubility ($gNaNH_2$/100 gNH_3)	0.16_8	0.14_9	0.14_0	0.13_0	0.11_4

In the ternary system the solubility of sodium amide or sodium chloride in liquid ammonia increased with the addition of sodium chloride or sodium amide resp. From the above results, the author found that the transition point of sodium chloride in the liquid ammonia is practically unaltered by the co-existence of sodium amide. Author.

45. **Studies on the growth of crystals. IX. The amount of foreign cations in the crystal formed in their presence in relation to their concentration in solutions.** T. Yamamoto. *Bull. Inst. Phys. Chem. Research*, **17**, 1278—1291 (1938).—Presence of some foreign cations in solns. favour the crystal growth of the solute. The amount (x) of such a cation occluded in crystal is related to its concn. (C) in soln. by a formula, $x=ac^b$ in case of Mn^{++} and Pb^{++} in NaCl crystals and Bi^{+++} in KCl crystals, a and b being consts. characteristic of the cations. The amt. of Mn^{++} and Cd^{++} in K_2SO_4 crystals is given by $x=a'+b'c$. The amt. of Bi^{+++} in NaCl crystals and that of Pb^{++} in KCl and KBr crystals were also detd. In case of foreign cations which do not influence the growth of crystals, e.g., Mn^{++} in KCl and KBr, Ni in NaCl and KCl, Cr^{+++} in NaCl and Pb^{++} in NH_4Cl, their amts. in the crystals are far smaller than those shown in the above-mentioned cases and are of the same order of magnitude for different cations and different crystals. From these results it may be concluded that the cations which favour the growth of crystals can occupy the lattice points of the crystals, while those which do not are only situated at the point of structural defect as impurities in general are.

Author.

46. **Cathode-ray investigation of thin**

layers formed on some single crystals. I. Oxidized surface of molybdenite. R. Ueda. *Proc. Phys.-Math. Soc. Japan*, **III**, 20, 656—666 (1938).—Thin layers of oxidation product formed at high temps. on a cleavage face of molybdenite were studied by the method of cathode-ray diffraction. The oxide was identified to be MoO_3 and the following two types of orientation were observed. 1) The (111) plane of MoO_3 is parallel to the cleavage plane of molybdenite, and the direction normal to it is a fibre axis. 2) The (010) plane of MoO_3 is parallel to the cleavage plane of molybdenite, and the (101) plane of the former is parallel to the (10$\bar{1}$0) plane of the latter. A possible interpretation is given for the new pattern.

Author.

47. **On the galvanomagnetic effect of ferromagnetic substance.** N. Hori. *Bull. Inst. Phys. Chem. Research*, **17**, 1166—1174 (1938).—The dependence of the galvanomagnetic effect of single crystals of ferromagnetic substance upon the direction of spontaneous magnetization is discussed, investigating the change of electric resistance tensor due to magnetization by symmetry operation of the cubic crystals. The results are as follows: 1) The potential difference due to the Hall effect of single crystals of ferromagnetic substance is strongly affected by the direction of spontaneous magnetization relative to the crystal-axes. 2) The said potential difference is theoretically expectable in the direction of magnetization (longitudinal Hall effect). 3) The Hall effect of polycrystals of the ferromagnetic substance is alse qualitatively explained by the theory in comparison with the exptl. results. Author.

48. **The relation between the surface dispersity of catalysts and the catalytic activities.** S. Tsutsumi. *J. Chem. Soc. Japan*, 59, 1407—1411 (1938).—The following three methods were proposed for the prepn. of cobalt-kieselguhr catalysts, and the activities were measured for the hydrogenation of benzene. Method I. A cobalt nitrate soln. was ppted. in the presence of kieselguhr with a potassium carbonate soln., and the ppte. obtained was washed with water and dried. Method 2. A cobalt nitrate soln. was ppted. with a potassium carbonate soln., and the ppte. obtained was washed with water, and being mixed with kieselguhr with a small amt. of water added, was dried. Method 3. A mixt. of cobalt nitrate and kieselguhr was roasted. Among these catalysts, the most active ones were those prepd. by Method 2, next those by Method 1 and then by Method 3. The optimum ratio of cobalt to kieselguhr was 1 : 10—1 : 20 in the case of the catalysts by Method 1, and 1 : 40 in the cases of those by Methods 2 and 3. The rate of the elevation of the optimum reduction temp. with the amt. of kieselguhr was largest in the case of the catalysts by Method 1, and smallest in the case of those by Method 2. The small rate with the catalysts by Method 2 can be attributed to the high degree of the dispersity of cobalt on kieselguhr. The conclusion reached in the hydrogenation of benzene was tested with a (4 Ni+1 Co)−7.5% Cr catalyst used for the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen.

Author.

49. **The chemistry of rain water.** Y. Miyake. *Journal Meteorological Soc. Japan*, **II**, **17**, 20—37 (1939).—From the analytical data of rain water in Tokyô, Kôbe and Hamamatu, the author obtained the following results. *Chloride.* 1. The yearly averages, Cl mg/L. Tôkyô 1.79, Kôbe 2.33, Hamamatu 2.39. 2. There is a marked positive correlation between chloride content and wind velocity. 3. There are group distributions in the chloride concn. as in the case of Köhler and Israël, although the principal values are not the same as those obtained by the above authors. 4. The ratio Cl/S, in rain water is larger than that in sea water, when sulphuric acid from coal can be eliminated. The possibility of the variation of Cl/S and Cl/Mg is discussed. *Sulphuric acid.* 1. Sulphuric acid content in rain water is larger in winter than in summer.

The yearly average: Tōkyō 1.86 S mg/L. 2. There is a parallelism between the yearly variation of sulphuric acid in rain and that in the atmosphere. *Ammonia.* 1. In the yearly variation of ammonia, the max. exists in June; this is in good agreement with that in air. 2. The yearly averages: Tōkyō 0.58, Kōbe 0.28. Hamamatu 0.19 N mg/L. *pH.* 1. The yearly averages: Tōkyō 4.1, Kōbe 5.2, Hamamatu 5.6. 2. It can be theoretically calcd. from the difference between the equiv. of sulphuric acid and ammonia. *Nitrite.* 1. The nitrite content in rain is very small when compared with that in air. 2. The yearly averages: Tōkyō 6.7, Kōbe 4.0. Hamamatu 2.7 N γ/L. 3. Nitrite content in rain water in the winter season is about twice of that in summer. Author.

50. **Electron diffraction by organic films. I. Fibroin, keratin and gelatine.** C. Matano. *J. Soc. Chem. Ind. Japan*, 42, 48—50 (1939).—The structures of films of fibroin, keratin and gelatine, were examd. by the electron diffraction method. The water sols were prepd. in the following way: for fibroin, the degummed silk was dispersed with magnesium nitrate and dialyzed; for keratin, the wool was dispersed with sodium sulphide and dialyzed; and for gelatine, a commercial gelatine was put in hot water. One drop of them was put on a sample holder and the water evaporated until a thin film of material was finally formed on the pin hole of the holder. The film was examd. by the beam of electrons of 20—60 KV. by using the electron diffraction app. of the Kikuti type. In all cases the diffraction patterns consisted of three diffuse rings whether they were due to the new films or aged ones. The intensity along the ring was uniform. The lattice distances calcd. from them (assuming Bragg's law) are nearly 4.1 Å, 2.0 Å. and 1.1 Å. From these results we may say that those proteins are of the similar structures and in the film they form pseudo-crystallites whose polypeptide chains are perpendicular to the surface of the film. Author.

51. **Catalytic reactions in the magnetic fields. (II—IV)** E. Ogawa. *J. Chem. Soc. Japan*, 60, 97—99 (1939).—The following expts. were made in order to produce an exptl. evidence on the relations between catalytic actions and magnetic moments of catalysts. The velocity of the reaction between ethylene and hydrogen was suppressed considerably when ferromagnetic catalysts (new K.S. magnet and nickel wire) were magnetised. In the reaction between allyl bromide and hydrogen bromide the production of 1.3 dibromopropane was also suppressed in the case of magnetised new K.S. magnet in contrast with that of non-magnetised. These results are probably due to the fact that the magnetic moments of molecular fields of ferromagnetic catalyst become so directed as to be unfavourable for adsorbed reactants. Author.

52. **Studies on absorption of gas in form of bubbles.** Y. Oyama and K. Iwase. *Sci. Papers Inst. Phys. Chem. Research*, 35, 131—157 (1939).—The absorption of the mixt. of carbon dioxide and air in the form of bubble by caustic soda soln. was carried out with the bubble, whose volume was in the range from 0.3 to 1.6 cc. The concns. of soln. used were 0.01, 0.1, and 0.25 N. The mode of motion of the bubble ascending in a liquid varies considerably according to its size. The mechanism of absorpsion of gas in the form of bubble is discussed. It is concluded that the finer subdivision of the gas to be absorbed is not always necessary to obtain the better result, and this was ascertained by the expt. results. The amt. of absorption per unit initial volume of the bubble increases with the decrease of its volume, but it reaches a max. value in a certain size, and with a further decrease of the volume it reduces to a min. value and then it enlarges towards the infinite value. The time required to build up the stationary condition in the liquid film was found to be ten to thirty times of that in case of oxygen absorbed by water. After the stationary condition built up in the liquid film, the rate of absorption is well expressed by the equation:

$v=k_1(n+HPg)$

k_1; the liquid film absorption coeff.

n; concn. of alkali in the bulk of soln.

H; Henry's const.

Pg; partial press. of CO_2.

The ratio of the instantaneous rate of absorption to the practical initial rate of absorption was detd., and its values were 3.6 for 0.01 N soln., 1.3 for 0.1 N. and 1.8 for 0.25 N resp. The reason why the very dilute soln had a remarkably large value is discussed. It is deduced that the rate of absorption in form of bubble is about ten to twenty times greater than that by the batch method. The coeff. of absorption of the liquid film (k_1) is expressed by the equation $k_1k'e^{-\alpha z}$, where z is the viscosity of soln., and k' and α are the consts. The influence of viscosity on the rate of absorption is far greater than that in the batch method. Authors.

53. **On the stabilization velocity of glassy selenium.** F. Ishikawa and H. Sutô. *Bull. Inst. Phys. Chem. Research*, 18, 143—149 (1939).—The stabilization velocity of glassy selenium was measured by means of differential gas dilatometer. At 60° it does not transform into the metallic form even on standing for 10 days. At 65° transformation proceeds slowly, but at 75° the velocity becomes quite large. The velocity curve has an autocatalytic form and is expressed by $dx/dt=kx^{\frac{2}{3}}$ till the velocity reaches a max. at about 50% change. Authors.

54. **On the lattice constants of picea jezoensis Carr.** Y. Matsunaga. *Jinkenkai. Japan*, 7. 42 (1939).—The lattice consts. of picea jezoensis Carr were exam. which gives an orientated figure as good as the native cellulose figure. But the diffraction figure of picea jezoensis Carr gives generally a very disorientated one. The values of $\frac{4}{\lambda^2}\sin^2\theta$ of the interference spots were calcd. from the above diffraction figure and found to coincide with those calcd. from the dimension of a unit cell of native cellulose obtained by U. Yoshida and C. Park. Accordingly, it may be concluded that the lattice consts. of picea jezoensis Carr are approximately equal to that of the native cellulose. Author.

55. **Notes on the kinetic theory of fluids.** T. Takéuchi. *Bull. Tokyo Univ. Eng.*, 7. 312—316 (1939).—The kinetic theory of fluids is applied to the surface tension and also to the compressibility. Using the modern idea of potential barriers, the theory of rates of chem. reactions is then extended to make it applicable to the rate of vaporization. Author.

56. **On the viscosity of liquids.** S. Kaneko. *J. Chem. Soc. Japan*, **60**, 321—324 (1939).—From the theory of reaction velocity, the following formula of viscosity is obtained.

$$\eta=\sqrt{\frac{7^2}{\pi}}\frac{(MRT)^{\frac{1}{2}}V_f}{\alpha V^{\frac{2}{3}}N^{\frac{1}{3}}}e^{-\frac{U}{kT}}$$

where η is viscosity, M molecular weight, R gas const., T absolute temp., V_f free volume, α transmission coeff., V molecular volume, N Avogadro's number, U activation energy, and k Boltzmann's const. Author.

57. **On the longitudinal magneto-resistance effect at various temperatures in iron-silicon alloys.** Y. Shirakawa. *Nippon Kinzoku Gakkai-Si*, 3, 83—91 (1939).—The change in magnetic resistance ($\Delta R/R$) of alloys of the system iron-silicon at various temps. ranging from −195° to 850° was measured up to 1600 oersteds in longitudinal magnetic fields. The specimen used was a fine wire, 0.33—0.77 mm in diameter and 1.52—6.40 cm in length. It is shown that the max. value of the $\Delta R/R$ in iron at about −100° (field intensity of 1500 oersteds) displaces towards higher temps. with increasing addition of silicon, and then its magnitude gradually decreases in respect to silicon content. The $\Delta R/R$ of the alloys containing more than 9.43% Si at all temps. and under any magnetic field is neg., its magnitude being especially large in alloys containing 14.60% and 16.03% Si. Author.

58. **Studies on solubilities. V. Solvency of mixed solvents (2).** S. Sugito and S. Miyake. *Tech. Repts. Kyushu Imp. Univ.*, **14**, 16—32 (1939).—The solubilities of cellulose acetate with 45—63% bound acetic acid in mixed solvents of ($CH_2ClCH_2Cl+CH_3OH$), ($CH_2ClCH_2Cl+C_2H_5OH$), ($CH_2ClCH_2Cl+C_6H_6$) were measured at 30°C. The dielectric consts., densities, refractive index of ($CH_2ClCH_2Cl+C_2H_5OH$), ($CH_2ClCH_2Cl+C_6H_6$) were measured at 30°C, and the molecular polarization and the mass moment, calcd. The relation between these values and the abnormal high solubilities in mixed solvents was examined. Authors.

59. **On the X-ray diagrams of fibre structures.** C. Matano. *Proc. Phys.-Math. Soc. Japan*, III, 14—20 (1939).—The formula of the intensity distribution of Debye rings due to the general fibre structures was deduced by using the conception of the reflection of X-rays by the crystallographic plane and of the diffraction as the undirectional grating by the zone in each crystallite, when the beam of X-ray was projected obliquely to the fibre axis. In both special cases—(1) when the crystallites are oriented at random, whatever the direction of the beam of X-rays may be, and (2) when the direction of the beam of X-rays are projected parallel to the fibre axis—the formula gives the uniform gives the uniform intensity distribution along each Debye ring as it ought to be. As further applications to the special cases, the calcd. values and the exptl. results were compared in the cases of the normal, oblique and parallel incidence of X-rays to the simple and ring fibre structures of the ramie fibres.
Author.

60. **Studies on the system of sucrose and liquid ammonia. I. Vapour pressure of the liquid ammonia solution of sucrose.** M. Amagasa, K. Itô and K. Nishizawa. *J. Soc. Chem. Ind. Japan*, **42**, 109—114 (1939).—The authors undertook a somewhat systematical studies on this system, and the vapour press. of the liquid ammonia soln. of sucrose, was detd. In this paper, the method for the detn. of vapour press. of the unsatd. soln. containing about 30~70% of sucrose is described and as the empirical equations relating concn.—vapour press. and temp.—vapour press. of this system, $P_0-P=a\,(e^{a.300+b.c-1})$ and $\log P_{mm}=A/T-C$ are resp. proposed. (P_0: vapour press. of pure solvent, P: vapour press. of the soln. having concn. of sucrose, c. a, b and A, C: consts.) The differentical heat of vaporization of this soln, and the molecular depression of vapour press. were calcd. from the above results. Finally the vapour press. of the satd. soln. of sucrose was qualitatively measured and from this result the solubility of sucrose in liquid ammonia was estimated.
Authors.

61. **On the dehydration of hydrated magnesium chloride. 1—Mutual relation between potassium and sodium chlorides added as addition agents.** S. Imatomi. *Sci. Papers Inst. Phys. Chem. Research*, 34, 1364—1376 (1938).—When hydrated magnesium chloride is heated with alkaline chlorides for dehydration, the water of crystallization is evaporated and a portion of magnesium chloride decomposes into magnesium oxide and hydrochloric acid. In the present paper the author tried to study the mutual relation between magnesium chloride and potassium and sodium chlorides used as addition agents in the dehydration process of magnesium chloride hexahydrate and their behaviours on the formation of magnesium oxide during the prepn. of magnesium electrolyte. Author.

62. **The reaction between magnesium oxide and titanium oxide in solid state. I.** Y. Tanaka. *J. Chem. Soc. Japan*, **60**, 212—218 (1939).—Mixts. of various compns. of MgO and TiO_2 were compressed to small cylindrical bodies and burned at 1400° for 10 hours. The specific gravity, solubility in HCl, shrinkage and porosity were measured, and X-ray analysis and microscopic obs. were also made. The conclusions obtained from these expts.

are as follows: (1) Three titanates, i.e. magnesium orthotitanate ($2MgO \cdot TiO_2$), metatitanate ($MgO \cdot TiO_2$) and dititanate ($MgO \cdot 2TiO_2$) are formed by the solid reaction between MgO and TiO_2. The purity of each of the titanates obtained from the three equivalent mixts. is 85—90%. (2) $2MgO \cdot TiO_2$ is soluble in 4n-HCl and $MgO \cdot TiO_2$ in 12n-HCl, while $MgO \cdot 2TiO_2$ is scarcely soluble even in 12n-HCl. (3) The crystal system of $MgO \cdot 2TiO_2$ may be considered as tetragonal, and the lattice consts. are: $a=4.94$ Å, $c=6.67$ Å. (4) The samples which contain $2MgO \cdot TiO_2$ and MgO give well sintered bodies: this may be due to the fact that both $2MgO \cdot TiO_2$ and MgO belong to the cubic system, and moreover, the lattice const. of the former is just twice as great as that of the latter. **II. Course of the reaction.** *ibid.*, 314—320 (1939).—(1) The compressed bodies of the mixts. of $MgO : TiO_2 = 1:2$, 1:1, 2:1 and 6:1 resp. were heated to 1000° and 1200° for various durations of time, and the course of the reaction was studied by detg. the compn. of the products analytically. The results were checked by X-ray analysis. For the sake of comparison, the expts. with powdered samples were also carried out. (2) At the beginning of the reaction $MgO \cdot 2TiO_2$ is formed always, whatever the mixg. ratio may be. When an excess of MgO is present, further reaction between $MgO \cdot 2TiO_2$ and MgO takes place, forming $MgO \cdot TiO_2$. (3) Similarly, $2MgO \cdot TiO_2$ is formed at last, but its formation is difficult in the temp. range studied here, except when a large excess of MgO is present. (4) The course of the reaction of the powdered samples is the same as above mentioned, although the reaction is slow. (5) According to Jander and Bunde (*Z. anorg. allgem. Chem.*, 293, 418 (1938)), $MgO \cdot TiO_2$ is formed at first in this reaction. Possible causes of the difference in the results are discussed. Author.

63. **On the specific gravities of liquid ammonia solutions of ammonium chloride and sodium chloride.** S. Kikuti. *J. Soc. Chem. Ind. Japan*, 42, 13—16 (1939).—By means of a sealed dilatometer made of hard glass, the author measured the specific gravities of pure liquid ammonia at several temps. The result was compared with the values of other investigators which seemed the most reliable at present, and the comparison attested the precision of the present measuring method. The max. probable error of the measurement was below 0.005% and the value of specific gravity is reliable up to 4 digits below decimal point. The specific gravities of various concns. of liquid ammonia solns. of NH_4Cl, NaCl, and their mixt. were measured at different temps. In the case of the mixt., the measurement was made with five different mixing ratios: 1:2, 1:1, 2:1, 4:1 and 8:1. By using a specially designed thermostat the measurements were performed within the temp. range between −30° and 70°C and the concn. range between zero and satn. From the results of measurements the second and the third orders of parabolic equations were applied for the relations between specific gravity and temp., and specific gravity and concn. resp., and then each const. was detd. from the above equations. When the calcd. and the measured values are compared, in general they agree well.

Author.

2—ATOMIC STRUCTURE, RADIOCHEMISTRY AND PHOTOCHEMISTRY

64. **The most probable values of e, e/m, and h. III.** K. Shiba. *Sci. Papers Inst. Phys. Chem. Research*, 34, 1308—1321 (1938).—Several years ago the present author estimated the most probable values of three fundamental atomic consts. namely, the elec-

tronic charge e, the specific charge of an electron e/m, and Planck's const. h. Since then many important data have been published, so that the values of these consts. should be newly discussed. The method of evaluation is not altered. The fact that the values thus obtained differ slightly from those obtained before may show the appropriateness of the method taking all available (more or less accurate) data into consideration.

Author.

65. **The scattering of D-D neutrons.** S. Kikuchi and H. Aoki. *Sci. Papers Inst. Phys. Chem. Research*, 34, 865—872 (1938).—It is one of the very important programs of the study of the nuclear phys. to investigate the collision cross section of the atoms for the neutron in relation to the atomic number or mass number, as well as to the energy of the incident neutrons. Tee present note describes the results of cross section measurement for 21 elements using D-D neutrons, which are monochromatic and 2.4 Mev in energy.

Authors.

66. **On the neutron groups.** Y. Sugiura and O. Minakawa. *Sci. Papers Inst. Phys. Chem. Research*, 34, 1299—1307 (1938).—There are several direct and indirect methods of detg. the neutron resonance energies. Since the neutrons of different groups have different velocities, the numerosity of neutrons of these groups after passing through paraffin is expected to depend on the thickness of paraffin layers by which the initial neutrons are slowed down. To accept this fact seems to be one of the simplest methods to establish the order of different resonance energies of different neutron groups. The activity curve is obtained by measuring the activity in a detector placed at a fixed distance from the neutron source, paraffin plates of various thicknesses being interposed between the detector and the source. It should have one max. at a certain thickness of paraffin, if the detector had one resonance level. Nishikawa, Nakagawa, and Sumoto pointed out that it was possible to detect the resonance groups by an analysis of the activity curve as a function of the number of thin paraffin plates of about 1.5 mm thickness interposed between a Rn+Be source and a detector. This method of detg. the neutron groups is similar to that of transformation of one resonance group into another, which was adopted by v. Halban and Preiswerk. The following expt. similar to that of Nishikawa, *et al.* was done under better geometrical conditions and with D+D neutrons. The detectors used here were Ag (22 sec), Rh (44 sec and 4.2 min), In (54 min), and I (25 min). Thus not only the order of different resonance energies of A, B, C, D, and I groups was estimated, but it was also found that the activities in those detectors were due to some multiple resonance levels of various energies.

Authors.

67. **On the band spectra of nitrogen forming a Rydberg series.** T. Takamine, T. Suga and Y. Tanaka. *Sci. Papers Inst. Phys. Chem. Research*, 34, 854—864 (1938).—Using a 1 metre vacuum spectrograph of Siegbahn type, the absorption bands of nitrogen forming a Rydberg series were studied. The absorption bands appear strongly when a condensed discharge is passed through a long helium tube, with the vacuum spectrograph containing a small amt. of nitrogen. Compared with the earlier work of Hopfield, these absorption bands are now extended to the 9th member. Of special interest is the appearance of an emission band also forming a Rydberg series and converging to the same limit ($A'\,^2\Sigma_u^+$ of molecular nitrogen) as that of the absorption bands. These emission bands are apparently due to the trace of nitrogen in the discharge tube which is present as an impurity.

Authors.

68. **On the method of treating the reaction between very light nuclei.** T. Nagakura. *Proc. Phys.-Math. Soc. Japan*, III, 20, 977—996 (1938).—After discussing the methods generally used, the author considered the state of the system all through the process as one of the stationary states of the system involving many elementary particles

and treated them as many body problems as rigorously as possible. In this stationary state there are various cases when the system seps. into some groups, each of which is an atomic nucleus, but he does not consider any one of these sepd. states as one of isolated stationary states, and so he does not directly construct the transition matrix out of interaction potentials. The transition probability is given by the intensity distribution of septd. groups. After discussing the new method, he applied them to ${}^{2}_{1}D+{}^{2}_{1}D$ reaction and earned good results. Author.

69. **β-ray spectra of radioactive antimony and sodium.** T. Amaki and A. Sugimoto. *Sci. Papers Inst. Phys. Chem. Research*, **34**, 1650—1657 (1938).—The radioactive antimony and sodium were prepd. with the aid of the cyclotron of the Institute of Phys. and Chem. Research. The β-ray spectra were studied by analyzing the tracks obtained in a Wilson cloud chamber situated in a magnetic field. The exptl. results are as follows:

	the half period	the upper limit obtained by K-U plot
Sb^{120}	16 minutes	1,53 Mev.
Sb^{122}	2,5 days	1,64 Mev.
Na^{24}	14,8 hours	1,76 Mev. and 0.81 Mev.

The K-U plot of sodium β-ray spectrum deviates considerably from a straight line and can be resolved into two components. Authors.

70. **β-ray spectra of Cu^{62}, Cu^{64} and Cu^{66}.** F. Yamasaki and K. Simma. *Sci. Papers Inst. Phys. Chem. Research*, **35**, 16—23 (1939).—The β-ray spectra of radioactive copper isotopes Cu^{62}, Cu^{64} and Cu^{66} were obtained by measuring tracks produced in a Wilson cloud chamber situated in a magnetic field. Extrapolating the K-U plots the energy upper limits were detd.: $Cu^{62}(e^+)$, 3.4 Mev; $Cu^{64}(e^-)$, 0.70 Mev; $Cu^{64}(e^+)$, 0.71 Mev; $Cu^{66}(e^-)$, 2.9 Mev. Authors.

71. **Influence of the fine-structure on the Stark effect of ionized helium.** H. Kubota. *Bull. Inst. Phys. Chem. Research*, **18**, 9—14 (1939).—The slight asymmetry observed in the Stark effect of ionized helium was compared with the theoretical values, which were calcd. by taking the effect of the fine-structure of the spectral terms into account. The theoretical values were calcd. from the standard perturbation theory of quantum mechanics, by taking the eigenstate of the Pauli's wave function as unperturbed state. Although the lack of power of the apparatus used prevents the author from the precise measurements, it can be stated that the result of comparison was affirmative. Author.

72. **On the capture of the mesotron by the atomic nucleus.** S. Sakata and Y. Tanikawa. *Proc. Phys.-Math. Soc. Japan*, **III**, **21**, 58—65 (1939).—In the first part of this paper, the non-relativistic theory of the interaction of mesotrons with heavy particles is developed. This theory is then applied to the absorption of a pos. (neg.) mesotron by an atomic nucleus with subsequent emission of a proton (neutron), and it is found that the cross-section per neutron (proton) in the nucleus is given by

$$\phi = 45 \times 10^{-28} \frac{C}{v} \mathrm{cm}^2 \qquad (v \ll C).$$

Authors.

73. **On atomic energy levels of $p^n p$ configurations.** T. Yamanouchi. *Proc. Phys.-Math. Soc. Japan*, **20**, 547—562 (1938).—The expressions for the atomic energy levels in LS-coupling are found by the well-known method of sums either by the explicit use of spin-eigenfunctions (Slater's method), or by the group-theoretical method, if each state (L, S) arises once for a given electron configuration. Specially in the latter method, the group characters only, but not the representation matrices, are needed for the calcn. When, however, more than two states with equal (L, S) arise, it is necessary, in order to find these energies separately, to construct the energy matrix, which is not detd. unless the eigenfunctions, i.e. the axes of reference indicating

the rows and columns of the matrix are specified. For this purpose it is convenient to specify the axes by assigning the origin of the states in constructing the atom by adding electrons one by one, which corresponds to the actual classification of the spectroscopic terms by assigning the parent terms. The diagonal elements then give the energies when the interactions between the states arising from different parent terms are neglected. This scheme was employed by the present author for the resultant spin S in constructing the representation matrices of the symmetric group σ_n, and to both L and S by Masiko for p^2p configuration. In this paper the method is described generally. It is then applied to p^3p and p^4p configurations, and the results are compared with the exptl. values. For p^5p, a special method is employed to take the spin-orbit interactions into account. Finally variation in the parameter values of F_2, G_0, G_2 for $2p^n3p$ (n=1, 2,....., 5) configurations are shown graphically. Author.

74. **On atomic energy levels of d^np configurations.** T. Yamanouchi. *Proc. Phys.-Math. Soc. Japan*, 20, 563—567 (1938).—As the sequence of the paper on the energy levels of p^np, the configuration d^np is investigated. In this case, however, it is troublesome to include all the terms arising, since the number of the states is large and moreover some of them arise many times. Also the exptl. data are not complete in most cases. The author, therefore, is chiefly concerned with the highest multiplet states, whose terms are fully known. Each state of this multiplicity arises twice at most, so that the energy matrices are obtained without constructing the transformation matrices. Only when these terms are not sufficient to dete. the parameters, other levels are taken into account, which have relatively simple expressions and have also been spectroscopically observed. Since the method of finding the energy formulas is similar as in I, it is briefly described and the results only are given for the rest. They are then compared with the terms of $3d^n4p$ configurations. The agreement between the observed and the calcd. values is satisfactory for this degree of approximation. Author.

75. **On the slowing down of neutrons in a proton gas.** K. Husimi. *Proc. Phys.-Math. Soc. Japan*, 20, 780—792 (1938).—The present paper deals with a gas kinetic calcn. of the process of slowing down of a group of neutrons in a gas of protons with a Maxwellian energy distribution. The author wishes to dete. the energy distribution of neutrons in the stationary state, which can be established by assuming a const. source of neutrons with a prescribed energy distribution and a finite capture probability. The author does not investigate the spatial distribution, so that the comparison of his calcn. with exptl. data is only possible if the tank of the gas is of infinitely large dimension. Even then his results cannot be compared with the existing data, since he utterly neglects the effect of chem. binding, which is known to be essential just in the lower energy regions where his special interest lies. His primary purpose is to clarify the question how far the naive conception that the neutrons can be classified into the "*fast*" group and the "*thermal*" group can be maintained from the more rational gas kinetic formalism. The calcn. is thus a direct extention of the pioneer work of Fermi, protons there treated as at rest being now supposed to be subjected to thermal agitation. Author.

76. **Partitio numerorum as occurring in a problem of nuclear physics.** K. Husimi. *Proc. Phys.-Math. Soc. Japan*, 20, 912—925 (1938).—By partitio numerorum $p_m(n)$ we understand the number of ways in which a given natural number n can be written as a sum of exactly m natural numbers. In connection with statistical theory of nuclear structure as propounded by Bohr, Dr. Umeda has recently undertaken a rather extended numerical computation of $p_m(n)$ and has shown, among others, that the "*mean number of excited particles*":

$$(0.1) \qquad \bar{m}(n)=\sum_{m=1}^{n} mp_m(n)/\sum_{1}^{n} p_m(n)$$

is almost exactly given by the empirical formula,

(0.1) $\overline{m}=n^{\frac{2}{3}}$,

within a fraction of a percent over a range of n up to $n=100$. The primary purpose of the present paper is to examine the natural conjecture if this expression can be obtained as an asymptotic value by analytical reasonings. The answer thus found is neg. The proper asymptotic expression is of more complicated structure. Author.

77. On the "neutron electron interaction" proposed by us and the gamma-rays in the D-D reaction. S. Kikuchi and H. Aoki. *Proc. Phys.-Math. Soc. Japan*, **21**, 20—25 (1939).—In the case of carbon the authors could not confirm the emission of the electron under the action of the fast neutrons, while in the case of lead they could confirm the emission of the electron. The fact may be accounted for by the internal conversion of lead atom excited by neutrons. A small amt. of gamma-rays coming from the deuterium target bombarded with deuteron was confirmed. As to the origin of the gamma-rays it is not yet certain that they are inherent to D-D reaction or of secondary origin excited in the substances constituting the target. The humber of the gamma-ray quanta relative to that of neutron is smaller than one in hundred. The authors take back their postulation as to the new kind of interaction between the neutron and the electron.

Authors.

78. On atomic energy levels of p^nd configurations. T. Yamanouchi. *Proc. Phys.-Math. Soc. Japan*, **21**, 47—51 (1939). —The energy expressions of an atom or an ion for a configuration containing more than three electrons are not in general obtained in a simple manner, since some of the states with the same (L, S) arise more than twice. The author has given a method for finding them for the case that one electron is added to a core whose energies for the specified configuration are all known, and thus he obtained the energies of p^np configurations. In the present note, it is extended to p^nd configurations (n=2, 3, 4). The method is quite similar to the former case, so it is not described in detail, and the final results only are given. The increase of the number of possible states makes the calcn. a little more troublesome. Indeed the energy matrices for the sets of orbitals (products of atomic eigenfunctions) with $\Sigma_m=1$ is 8-dimensional. By suitable application of the principle of spectroscopic stability, however, the labour is much saved, as the example given shows. The present method, in which spinless eigenfunctions are used throughout, would be most convenient for such a problem, since the number of orbitals belonging to this configuration is large, and hence the use of spin functions, which doubles the number of each of individual eigenfunctions, leads to great complexities. Also the specification of the multiplet states of the core is easy in this treatment. Author.

79. Beta-ray spectrum of ^{13}N. S. Kikuchi, Y. Watase, J. Itoh, E. Takeda and S. Yamaguchi. *Proc. Phys.-Math. Soc. Japan*, **21**, 52—58 (1939).—The energy spectrum of disintegration positive electrons of ^{13}N was studied by means of a magnetic spectrometer. ^{13}N was obtained by bombarding carbon with high energy deuterons produced by the Osaka cyclotron. In the case of ^{13}N, Richardson reported that it emits gamma-rays. With the method similar to that of Richardson the authors also obtained the indication of existence of low energy gamma-rays (though not conclusive). From the exptl. results one may conclude that the rest energy of neutrino cannot be greater than 0.05 mc^2. J.C.L.

80. The scattering of fast neutrons by atoms. S. Kikuchi and H. Aoki. *Proc. Phys.-Math. Soc. Japan*, **21**, 75—89 (1939). —Recently, the authors measured the cross section of 21 elements for D+D neutrons and obtained the result which suggested that there is an interesting relation between the

cross section and the atomic number. The present note describes the results of their new series of measurement which are much more accurate than their previous measurement and are extended to 37 elements. As the neutron sources both D-D and Li-D neutrons are used. Authors.

81. **Studies on luminescent materials. Part I. Theory of zinc sulphide-copper crystalphosphor.** Y. Uehara. *J. Chem. Soc. Japan*, **60**, 133—138 (1939).—The author attempted to interpret the properties of zinc sulphide-copper crystalphosphor from the viewpoint of zone theory. It is pointed out that the activation center of this phosphor consists of Cu^+ ion surrounded by the Zn^{++}, S^{--} or S^- ions in the lattice, and that this Cu_n^+ ion is responsible for the luminescence and photoconductivity. According to this interpretation, it is concluded that the excitation bands of zinc sulphide-copper crystalphosphor may be correlated with the transitions:

$$^1S_0 \longrightarrow {}^1D_2$$
$$^1S_0 \longrightarrow {}^3D_1$$
$$^1S_0 \longrightarrow {}^3D_2$$
$$^1S_0 \longrightarrow {}^3D_3$$

of the Cu^+ ion in the activation center, and that two fluorescence bands may be observed in this phosphor which arise from the transitions

$$^3D_3 \longrightarrow {}^1S_0 \text{ (green, } \alpha\text{-band)}$$
$$^3D_2 \longrightarrow {}^1S_0 \text{ (blue, } \beta\text{-band)}$$

of the Cu^+ ion in the activation center.

Author.

82. **Current-carrying capacity of bare conductors.** T. Yamanouchi. *Furukawa Elec. Co.*, **10**, 21—38 (1938).—Under a mech. load of 10 kgs/mm², electric current was passed through the test-samples of the wires that they might be kept at temps. of 75°C., 100°C., 125°C., 150°C., and 200°C., resp. for 4 hrs. a day, after which they were cooled at room temp. for 20 hrs. After having undergone this process thirty times, they were subjected to mech., microscopic and X-ray diffraction tests with the results obtained, which clearly denote changes in their properties and structures. From these results and also from the results obtained by authoritative experts in Europe and America, it is concluded that, in detg. the current-capacity of aerial transmission wires, it is necessary to fix their loading current at a temp. not exceeding 100°C.

Author.

83. **On the equilibrium in the reduction of stannic oxide by hydrogen and deuterium.** F. Ishikawa and S. Andô. Sci. Papers Inst. Phys. Chem. Research, **34**, 873—887 (1938).—The equil. in the system $SnO_2(s)+2H_2(g) \rightleftarrows Sn(l)+2H_2O(g)$ has been measured at 650—803°C by the method free from the effect of thermal separation of gaseous mixt. The result may be expressed by the equation: $\log K_p^{\frac{1}{2}}=\log p_{H_2O}/p_{H_2}=-2295.8/T+2.68297$. From the results the following thermodynamic values have been obtained. $SnO_2(s)+2H_2=Sn(s)+2H_2O(g)$, $\Delta F^\circ=26089+5.95T\ln T+0.001358T^2-0.00000082_5T^3-126000/T-69.78T$. $\Delta F^\circ_{298}=15071$ cal. $Sn(s)+O_2=SnO_2(s)$, $\Delta F^\circ_{298}=-124087$ cal. The equil. const. of water gas reaction has been derived by combining the above result with the equil. const. of $Sn+2CO_2 \rightleftarrows SnO_2+2CO$, and the result shows a good agreement with the values directly obtained by Hahn. The same reduction equil. with deuterium has been studied by the same method at 650°—820°C, and the result may be expressed as follows: $\log K_D^{\frac{1}{2}}=\log p_{D_2O}/p_{D_2}=-1928.6/T+2.4323$. The equil. const. of the exchange reaction $H_2O+D_2 \rightleftarrows D_2O+H_2$ may be computed by combining the above results, and compared with the values calcd. by the equations of L. Farkas and A. Farkas.

Author.

84. **On the dielectric constant of mixtures.** S. Kaneko. *Researches Electrotech. Lab.*, 2, 449—450 (1938).—Burton and Turnbull (*Proc. Roy. Soc.* 158—182 (1927)) calcd. the dielectric const. of powders suspended in oil utilizing Frick's equation of the dielectric const. of mixts. (*Phys. Rev.* 2—575

(1924)). Their method of calcn. is, however, very complicated and the author shows a simpler method. Author.

85. **Diffusion potential difference.** H. Yamada. *Kyoto Furitsu Ika Daigaku*, **21**, 1161—1164 (1937).—In the method of N. Bjerrum of eliminating diffusion potential defference it was found to be advantageous to use agar-agar connection containing satd. and incompletely satd. KCl solns. instead of using satd. and incompletely satd. KCl solns. J. C. L.

3—ELECTROCHEMISTRY AND THERMOCHEMISTRY

86. **The heats of formation of various nitrides.** S. Satoh. *Sci. Papers Inst. Phys. Chem. Research*, **34**, 1364—1376 (1938).—The heats of formation of various nitrides and azides were tabulated against the atomic numbers of their constituent elements. From the figure, the heats of formation of nitrides hitherto considered difficult to dete. were roughly predicted. The results obtained are as follows:

$$\frac{1}{2}(N_2)+[As]=[AsN]-33.9 \text{ kcal.}$$

$$\frac{1}{2}(N_2)+[Sc]=[ScN]+75.0 \quad ,,$$

$$\frac{1}{2}(N_2)+\frac{3}{2}\{Br_{liq}\}=NBr_3-80.3 \quad ,,$$

$$\frac{1}{2}(N_2)+[Hf]=[HfN]+78.3 \quad ,,$$

Author.

87. **On the theory of electrolytic conduction. II.** S. Kaneko. *Researches Electrotech. Lab.*, **3**, 99—100 (1939).—In the previous discussion, the motion of ions is limited in the directions parallel and vertical to the electric field, but in this report such an arbitrary assumption is removed and the following relation is obtained between conductivity $\varkappa$ and the strength of the field E:

$$\varkappa=\frac{Nc\varepsilon^2z^2\lambda k_1}{6kT}\left(\frac{2}{x^2}\cosh x-\frac{3}{x^3}\sinh x\right)$$

$$x=\frac{\varepsilon z\lambda E}{2kT}$$

where N is Avogadro's number, C concn., ε the charge of an electron, z valency of an ion, λ distance of one jump, k_1 transition velocity, k Boltzmann's const., T absolute temp. Author.

88. **The specific heats of manganese nitrides.** S. Satoh. *Sci. Papers Inst. Phys. Chem. Research*, **35**, 24—31 (1938).—As the specific heats of manganese nitrides had not yet been detd., the mean specific heats of manganese nitrides were measured by means of the ice calorimeter over three temp. intervals: 0°C—99.5°C, 0°—305°C, and 0°C—500.3°C and the equations of the true specific heats within the limit of these temp. intervals were obtained:

Mn_3N_2: $C=0.1468+1.168\times10^{-4}t+4.992\times10^{-9}t^2$.

Mn_5N_2: $C'=0.1382+1.112\times10^{-4}t+1.630\times10^{-8}t^2$.

Mn_8N_2: $C''=0.1280+1.106\times10^{-4}t+3.651\times10^{-8}t^2$.

Author.

89. **The heat of formation of manganese nitrides.** S. Satoh. *Sci. Papers Inst. Phys. Chem. Research*, **35**, 158—169 (1939).—As the heat of formation of manganese nitride (Mn_8N_2) is not yet known nor has the heat of formation of manganese nitride (Mn_5N_2) been computed from its dissociation press., the heats of formation of Mn_8N_2 and Mn_5N_2 were detd. from the dissociation press. by the use of the specific heats of both substances which were measured by the author.

$$8Mn+N_2=Mn_8N_2+79.8 \text{ kcal,}$$

$$5Mn+N_2=Mn_5N_2+57.0 \text{ kcal.}$$

The result (57.0 kcal) may be considered to be in fairly good agreement with the values obtained directly by the use of various calorimeters. Author.

90. **Theory of overvoltage.** S. Kaneko. *Bull. Electrotech. Lab.*, **3**, 147—148 (1938).—By the application of Horiuti's theory of reaction velocity (*Bull. Chem. Soc. Japan*, 13—210 (1938)) the following relation is obtained between overvoltage E and current i:

$$i = n\varepsilon\sqrt{\frac{kT}{2\pi m}}\, e^{-\frac{U^*}{kT}}\left(e^{\frac{\varepsilon E}{2kT}} - e^{-\frac{\varepsilon E}{2kT}}\right)$$

where n is the number of hydrogen ions in unit volume, ε the charge of an ion, k Boltzmann's const., T absolute temp., m mass of an ion, U* activation energy. Author.

91. **On the electrode potential of the carbon electrode of air cell and hydrogen ion concentration. II.** S. Makino and J. Yoshida. *Researches Electrotech. Lab.*, **3**, 148—150 (1938).—The relation between the electrode potential of the carbon electrode of air cell and hydrogen ion concn. of electrolyte was investigated. The electrodes were prepd. from the samples different from those mentioned in the previous report. The electrode potential obtained is not shown as a linear function of *pH*. Authors.

92. **On the electric conductance of fused salts. Polarization capacity and cell constant.** Y. Yamaguchi and S. Shishido. *J. Chem. Soc. Japan*, **59**, 1311—1320 (1938).—The measurement of electric conductance of fused $AlCl_3$ mixed with NaCl was carried out with a new app. similar to Molton's valve detector. This valve detector is very useful for detn. of high conductivity. It is found that the expression derived by Molton for an equil. point of a conductance bridge is imperfect. Indeed, if there is neither capacitance nor inductance in the bridge, it is sufficient, but not for the one containing these impedances. Usually, in the case of detns. of low electrolytic resistances like those of fused salts, a polarization capacity between electrodes and electrolyte in a conductance cell disturbs its accurate detn. An app. and a method of evaluating the deviation due to the capacitance is described. And it is also observed by this app. how the surface condition of electrodes exerts influences on the polarization capacity. The conductivity of molten $AlCl_3$ mixed with NaCl is pretty large and linearly increases with temp. in the range from 180° to 280°. Authors.

93. **Theory of dielectric loss in solids.** S. Kaneko. *Researches Electrotech. Lab.*, **3**, 28—30 (1938).—By the application of Eyring's theory of reaction velocity the following relations are obtained between dielectric loss and frequency

$$\tan\delta = \frac{\varepsilon_1 - \varepsilon_0}{\varepsilon_1 + \varepsilon_0 x^2}\, x$$

$$x = \frac{\varepsilon_1 + 2}{\varepsilon_0 + 2}\,\omega\tau,$$

where δ is loss angle, ε_0, ε_1, dielectric const. when $\omega = 0$ and $\omega = \infty$ resp., τ relaxation time. Between τ and absolute temp. T there holds the following relation, $\tau = ae^{b/T}$ where a and b are consts. Author.

94. **The specific heats of thorium nitride, lithium nitride, and zinc nitride.** S. Satoh. *Sci. Papers Inst. Phys. Chem. Research*, **35**, 182—190 (1939).—The mean specific heat of thorium nitride was measured by means of an ice calorimeter over three temp. intervals 0°C~99.5°C, 0°C~305.3°C, and 0°C~500.3°C, and the equation of the true specific heat within the limit stated by these temp. intervals was obtained: $C = 0.04895 + 4.436 \times 10^{-5}t - 1.384 \times 10^{-8}t^2$. The mean specific heat of lithium nitride was detd. by the same method over three temp. intervals 0°C~99.6°C, 0°C~305.3°C, and 0°C~500.3°C and the equation of the true specific heat within the limit over these temp. intervals was obtained: $C = 0.5127 + 7.226 \times 10^{-4}t - 1.193 \times 10^{-7}t^2$. The mean specific heat of zinc nitride was measured by the same method over three temp. ranges 0°C~99.6°C, 0°C~305.3°C and 0°C~419.2°C, and the relation between the true specific heat and temp. was found to hold

over these temp. ranges: $C=0.1142+8.926\times10^{-5}t+1.151\times10^{-5}t^2$. Author.

95. **The measurement of *pH* by means of the glass electrode and the hydrolysis of copper sulphate.** H. Hagisawa. *Bull. Inst. Phys. Chem. Research*, 18, 275—284 (1939).—The *pH* values of $CuSO_4$ solns. were measured at 25° by means of a glass electrode using the following cells:

$$\mathrm{Hg|HgCl,\ KCl(sat.)}\left|\begin{matrix}0.1N\,CH_3CO_2H\\0.1N\,CH_3CO_2Na\end{matrix}\right|\mathrm{Glass|}$$
$$\mathrm{CuSO_4(m)|KCl(sat.),\ HgCl|Hg}$$
$$\mathrm{Hg|HgCl,\ HCl\ (0.1}N\mathrm{)|Glass|CuSO_4(m)|}$$
$$\mathrm{KCl(sat.),\ HgCl|Hg.}$$

The *pH* values obtained are as follows:

Dilution (V)	1	2	5	10	20
pH	3.260	3.612	3.965	4.186	4.412
Dilution (V)	50	100	200	500	1000
pH	4.664	4.861	5.056	5.322	5.523
Dilution (V)	2500				
pH	5.824				

The relation between log V and *pH* may be expressed as follows:

$pH=3.5200+0.6717\log V$ (Dilution greater than 10)

From these results the hydrolysis may be represented by the equation—$2Cu^{++}+2H_2O\rightleftarrows Cu_2(OH)_2^{++}+2H^+$. According to the classical theory of soln., the hydrolysis const. K_h was found to be 1.38×10^{-11}, and according to the theory of strong electrolytes, $1\sim3\times10^{-11}$. Author.

96. **On the hydrolysis of zinc sulphate and the formation of basic sulphate.** H. Hagisawa. *Bull. Inst. Phys. Chem. Research*, 18, 368—381 (1939).—Using the zinc sulphate crystals which were obtained by cooling a soln. satd. at 70° to 0°, the *pH* values of solns. of various concns. were measured, and the result may be represented by the following equation: $pH=5.340+0.4417\log V$ (Dilution $V=10\sim1000$). Based on these results, the hydrolysis of zinc sulphate is discussed, and the following equation is considered most adequate to the exptl. results: $Zn^{++}+H_2O\rightleftarrows ZnOH^++H^+$. The hydrolysis const. was calcd. as follows: $K_h=(a_{ZnOH^+}\times a_{H^+})/a_{Zn^{++}}=6.5\times10^{-11}$ (25°). The potentiometric titration of zinc sulphate soln. with NaOH was performed at 25° by means of a glass electrode. When the concn. of $ZnSO_4$ was greater than 0.0074 mol/*l*, the ppte. had the composition $ZnSO_4 3Zn(OH)_2$, which was ascertained by the analysis of the ppte. When the concn. was very small (0.0004955 mol/*l*), the ppte. was $Zn(OH)_2$ and its solubility product was found to be 3.4×10^{-16}. Large differences in the solubility product of $Zn(OH)_2$, according to the author's opinion, may be due to the different state of aggregation of the ppte. when produced from solns. by the addition of alkali under various conditions of expts. Author.

97. **On the energy states of the valency electrons in some metals. I, 10. Anomalous changes of various properties of zinc with temperature.** M. Satô. *Sci. Repts. Tohoku Imp. Univ.*, I, 27, 278—325 (1939).—The exptl. evidences concerning anomalous changes in various properties of zinc with temp., in solid as well as in liquid state, were closely studied, and it was found that there exist 11 anomalies and that they can be classified into 4 groups; further that, if we take into account the absolute zero reading to each of them, the temp. intervals in each are in the ratio of a sequence of natural numbers as shown in the following table. Anomalous temps. in °K (number in parenthesis is interval ratio):

Group 1; 0 (5) 247 (4) 443 (3) 593 (2) 692 (melting point).
Group 2; 0 (4) 473 (3) 823 (2) 1069 (1) 1178.
Group 3; 0 (2) 36 (3) 90.
Group 4; 0 ? 0.79 (transition point of supra-conduction).

It is thus seen that the anomalies at 443°K (170°C) and 593°K (320°C) which have been long discussed, as well as the others, are to be attributed to zinc itself. Author.

4—COLLOID CHEMISTRY AND SURFACE CHEMISTRY

98. **On the nature of foam. I. Stability of the foam produced by the aqueous solutions of alcohols and acids.** T. Sasaki. *Bull. Chem. Soc. Japan*, 13, 517—526 (1938).—An app. for the measurement of the stability of foam was described and the stability was measured by the height of the foam produced by the air current of a const. velocity. The relation between the velocity of the air current v and the height H of the foam produced was examd. and the equation $S \cdot v = H - a$ has been obtained, in which S is the stability of foam and a a const. The value a was negligible compared with H under the conditions of the present expts. The measurements of the stabilities were carried out for the aqueous solns. of alcohols and fatty acids, from which several conclusions were obtained. Author.

99. **On the silver chromate banding in silicic acid gel.** T. Isemura. *Bull. Chem. Soc. Japan*, 13, 489—493 (1938).—The formation of silver chromate bands in silicic acid gel made by a usual method is described. By this procedure, the concn. of chromate is regulated at will, and distinct banding is formed. The hydrogen ion concn. of the gel has a profound influence on the formation of rhythmic bands of silver chromate. Dhar and Chatterji's theory and the membrane theory are not applicable. Author.

100. **On the calcium phosphate banding in silicic acid gel.** T. Isemura. *Bull. Chem. Soc. Japan*, 13, 493—504 (1938).—The formation of rhythmic ppte. of calcium phosphate in silicic acid gel is described. The formation of this rhythmic ppte. is strongly affected by the hydrogen ion concn. of the gel. The effects of the concns. of inner and outer electrolytes and the gel on this rhythmic ppte. were studied. When the concn. of the inner electrolyte ($CaCl_2$) was sufficiently great, no diffusion of the outer electrolyte into the gel took place but reversely calcium salt diffused into the outer electrolyte soln. and dendrites were formed in the outer soln. The effect of the existence of a third substance in the gel and in the diffusing electrolyte, was also investigated. The existence of it in a diffusing electrolyte had almost no influence but its existence in the gel had some effects, especially in the case where potassium bromide and iodide were used as the third substance. Author.

101. **The sorption of chlorine by active charcoal. III. On the rate of the sorption.** K. Arii. *Bull. Inst. Phys. Chem. Research*, 17, 717—738 (1938.)—The rate of the sorption of chlorine by sugar charcoal activated by heating at 900°C for two hours, was detd. at 20°, 30°, and 40°, and at const. pressures (200, 400, 600 mm). The instrument used for the measurements was an all-glass apps. which contained Jackson's glass-spring manometer and McBain's quartz-spring balance. The following results were obtained: 1) The results obtained are in good agreement with Bangham's equation, $x = At^B$, where x is the sorption amt. in mg per 1 g charcoal at a time t, and A and B are consts. 2) A new equation of sorption velocity for const. pressure is derived from the exptl. data, $x_p = (\alpha - \beta T)t^{(k+lT)}$, and another equation, for const. temp., $x_T = \gamma p^S t^{(m - n \log p)}$. 3) The following general equations are derived, $x_I = A_I t^{B_I}$ $x_{II} = A_{II} t^{B_{II}}$, where

$A_I = (a' + a'' \log p) - (\beta' + \beta'' \log p)\, T$,

$B_I = (k' - k'' \log p) + 10^{(l' - l'' p)}\, T$,

$A_{II} = (\gamma_0 - \gamma_1 \log T) p^{(\delta_0' + \delta_1 T)}$,

$B_{II} = (m_0 + m_1 T) - (n_0 + n_1 T) \log p$.

4) It takes 65 days to reach the sorption equil. at const. pres., but the sorption amt. for one minute amts. to about 8.5～23 per cent of the equil. value. From this result, the present author agrees in the opinion proposed by McBain that the sorption of a gas by porous adsorbent consists of two independent

phenomena i.e. adsorption and absorption.
Author.

102. **On the effect of other ions upon the surface activity of aqueous solutions of organic ions with hydrophobic groups.** Y. Mutô. *Proc. Phys.-Math. Soc. Japan*, **III**, **20**, 646—652 (1938).—Organic ions with hydrophobic groups have tendency to be adsorbed in the surface of the soln. on account of those groups, but on the other hand image force repulsion caused by their electric charge will counteract this. When we consider only the latter effect the work necessary to bring the ion from interior of the soln. to the place x underneath the surface is $W=\exp(-2\varkappa x)e^2/4Dx$, where $\varkappa=4\pi\Sigma n_i e_i^2/DkT$. W becomes less when concn. of ions becomes higher. Hence the amt. of organic ions adsorbed becomes large with the concn. of ions in general, that is, with the addition of some electrolytes which have no special effect upon the organic ions. Under some assumptions formulae are deduced which express the relation between $\varkappa$ and the adsorbed amt., and the validity of these is considered. Under suitable conditions the surface concn. is proportional to $\varkappa/\{1+\exp(-2\varkappa a)\}$, where a is the mean distance between the centre of charge of the adsorbed ion and the surface. Author.

103. **Studies on the sorption of gases and vapours by titania gel. V. Variation in the sorptive capacity of titania gel by the addition of Fe_2O_3-gel and difference between the sorptive capacities of α- and β-titania gel.** I. Higuti. *Bull. Inst. Phys. Chem. Research*, **18**, 15—26 (1939).—A number of isotherms for water vapour were taken at 20°C using several mixts. of titania and ferric oxide gels which were prepd. by co-pptn. from the mixed solns. of these salts. Each isotherm seems to be divided into two different parts. The first part was lowered in proportion to the amt. of Fe_2O_3 and the second was far higher than that in the isotherm for each component gel. From this result it may be concluded that the first part is due to the ordinary adsorption the second part to the condensation of the sorptive into the capillary pores of the adsorbent. The above consideration was also confirmed by the obsn. of the change in form of isotherms at 20°C with a mixed gel ($2Fe_2O_3 \cdot 3TiO_2$). The first part of these isotherms decreased rapidly as the temp. of heating increased just as that of the isotherms for the pure titania gel, but the effect of heating on the second part was found to be far less than in the case of the pure gel. Another evidence for this view may be obtained by comparing the sorptive capacity of α gel with that of β gel. The total sorptive capacity of both gels may be influenced by such various conditions as coagulation, drying, dehydration, etc., and indicates no proper characteristics of the gels. However, if we pay attention only to the first part of these isotherms, α gel shows always higher adsorptive capacity than the β gel.
Author.

104. **On the nature of foam. II. The foam formation of ternary system, acetic acid—ethyl ether—water.** T. Sasaki. *Bull. Chem. Soc. Japan*, **13**, 669—678 (1938).—The foam formation of the liquid ternary system of acetic acid—ethyl ether—water was measured by means of a shaking app. which was properly constructed for this purpose. The life time of foam produced and the height of foam zone were measured. The diagrams were made between the degree of foam formation and the composition, and several conclusions were obtained on the foam formation of the mixt. belonging to homogeneous and heterogeneous regions of the above ternary system. Author.

105. **Studies on the precipitation of hydroxides and on some related phenomena.** T. Katsurai. *Sci. Papers Inst. Phys. Chem. Research*, **35**, 191—227 (1937).—The behaviours of some inorganic salts and gels at temps. higher than 100°C were studied by means of autoclave treatment. The solns. of $AlCl_3$, $MnCl_2$, and $CoCl_2$ hydrolyse noticeably

above 120°C. The progress of hydrolysis was traced by the measurement of turbidity. It was confirmed by means of Debye-Scherrer's method that the structures of the hydrolysis product and the dehydration product are identical with that of hematite. The prepn. of ferromagnetic compounds by means of autoclave treatment does not seem to be promising. Light absorption and turbidity of the mixt. $FeCl_3+NH_4OH$ were measured. For the wave length 615 m μ, the light absorption follows the Lambert-Beer law with respect to the concn. of NH_4OH. By adding and alkaline soln. to the mixt. of $Fe^{\cdot\cdot}$ and $Fe^{\cdot\cdot\cdot}$ salts, a dark compact ppte. was obtained. The ppte. had the same structure as natural magnetite and was very stable above 100°C. By supersonic waves a hydrosol of magnetite was obtained. Under certain assumptions a differential equation of sedimentation and diffusion of magnetic colloid in a heterogeneous magnetic field was derived. The minerals, northupite and tychite, were artificially prepd. by means of the autoclave treatment of gels. The change of several metallic hydroxides and the coagulation of various ferrocyanide hydrosols, silver halide sols and arsenic trisulphide sols and the hydrolytic decomposition of potassium ferrocyanide and potassium ferricyanide above 100°C were studied.

J. C. L.